

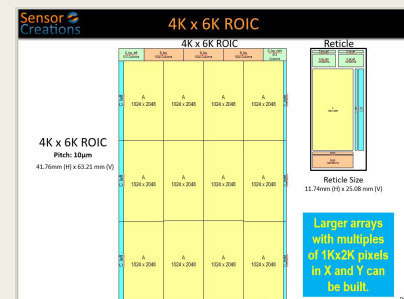
Novel Read-Out Integrated Circuit with Individual Pixel Programmability for Astronomy Infrared Focal Plane Arrays, Phase II

Completed Technology Project (2017 - 2020)



Project Introduction

One of the key components in many NASA missions is a large-format focal plane Focal Plane Array (FPA) to capture images or two-dimensional, hyperspectral information, especially in the Infra-Red (IR) domain. Apart from the detector, the performance of these FPAs is determined by the Read-Out Integrated Circuit (ROIC) that amplifies and multiplexes photo generated charge for signal processing by peripheral circuitry. In this project, we propose to develop a new ROIC for low background applications, specifically designed to overcome present limitations of image persistence and inter-pixel capacitance (IPC). The main innovation in this project is an adaptive unit cell that can be individually and randomly programmed via on-chip logic to control bias state and reset duration of any pixel in the array while the integration of science data is on-going. In Phase I we conducted a pixel trade study and performance evaluation for a Capacitive Trans-Impedance Amplifier (CTIA) and a source follower per detector (SFD) type pixel using analog circuit simulations. Then we generated the optimum unit cell layout, defined the overall architecture and created the top-level schematic. By the end of Phase I we have completed the blue prints for the design. The completion of the top-level schematics, verified through simulation, is a critical milestone in the development. It substantially reduces the risk associated with creating new ROIC technology and will allow us to efficiently fabricate and test the device in Phase II. All results from Phase I are documented in a preliminary Interface Control Document (ICD) so that the new ROIC can be considered for future missions. In Phase II we will produce the layout of the entire chip for fabrication using stitching lithography in a state of the art CMOS foundry and demonstrate its functionality on packaged prototypes. By the end of Phase II, wafers of a known functioning ROIC design will be available for hybridization.



Novel Read-Out Integrated Circuit with Individual Pixel Programmability for Astronomy Infrared Focal Plane Arrays, Phase II Briefing Chart Image

Table of Contents

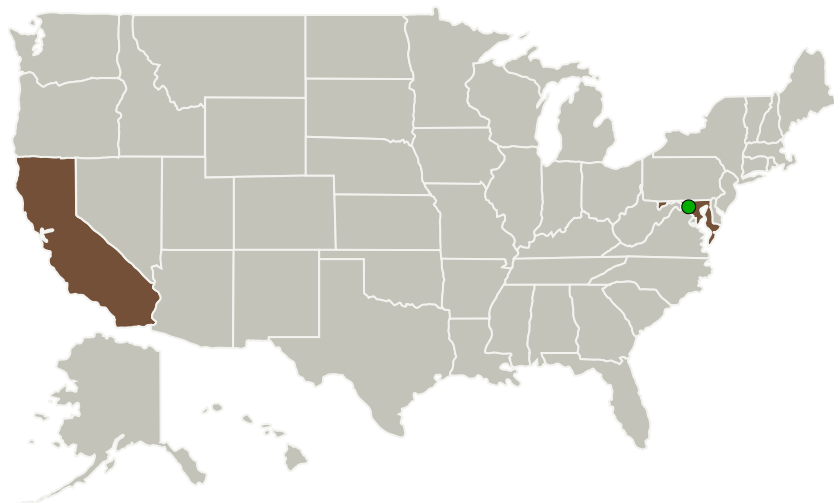
Project Introduction	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Technology Areas	3
Target Destinations	3

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Sensor Creations, Inc.	Lead Organization	Industry	Camarillo, California
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
California	Maryland

Project Transitions

April 2017: Project Start

January 2020: Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140875>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Sensor Creations, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

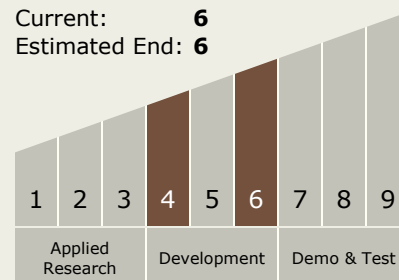
Carlos Torrez

Principal Investigator:

Stefan Lauxtermann

Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**

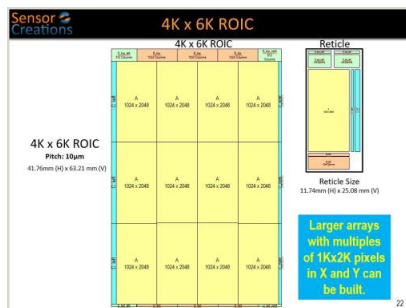


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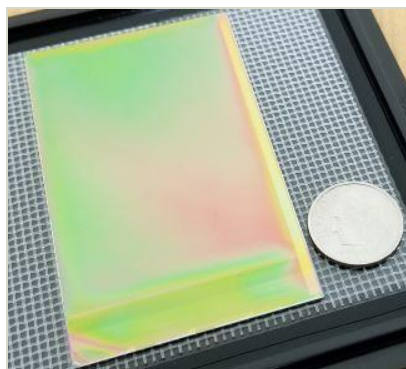


Images



Briefing Chart Image

Novel Read-Out Integrated Circuit with Individual Pixel Programmability for Astronomy Infrared Focal Plane Arrays, Phase II Briefing Chart Image
(<https://techport.nasa.gov/image/130776>)



Final Summary Chart Image

Novel Read-Out Integrated Circuit with Individual Pixel Programmability for Astronomy Infrared Focal Plane Arrays, Phase II
(<https://techport.nasa.gov/image/129166>)

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.1 Detectors and Focal Planes

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System